Introduction to a metadata database developed by the Inter-university Upper atmosphere Global Observation NETwork (IUGONET) project

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- Recent Advances in Observational Studies of the Tropical Atmosphere and Ionosphere -

Introduction to a metadata database developed by the Inter-university Upper atmosphere Global Observation NETwork (IUGONET) project

- **H. Hayashi, Y. Koyama, T. Hori, Y. Tanaka, M. Kagitani, A. Shinbori, S. Abe, H. Kouno, D. Yoshida, S. UeNo, N. Kaneda, and IUGONET project team**

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The IUGONET project – Objectives

The IUGONET project aims at building "e-infrastructure" for researchers to effectively find, get, and analyze various kinds of upper atmospheric data spread over universities and institutes.

- *Distributes ground-based observational data accumulated over 50 years since IGY (both digital and analogue data)*
- *Promotes analyses of multi-disciplinary data, which will lead to comprehensive studies of mechanisms of long-term variations in the upper atmosphere*

Participating universities and research institutes

- Planetary Plasma and Atmospheric Research Center, **Tohoku University**
- **National Institute of Polar Research**
- Solar Terrestrial Environment Laboratory, **Nagoya University**
- Research Institute for Sustainable Humanosphere, **Kyoto University**
- World Data Center for Geomagnetism, **Kyoto University**
- Kwasan and Hida Observatories, **Kyoto University**
- Space Environment Research Center, **Kyushu University**

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Observations by IUGONET institutions

● Optical Observation ▲ Radar Observation ◆ Magnetometer Observation

■ Tohoku Univ. ■ NIPR ■ Nagoya Univ. ■ Kyoto Univ. ■ Kyushu Univ.

Svalbard
IS radar (EISCAT)
meteor radar
aurora imager

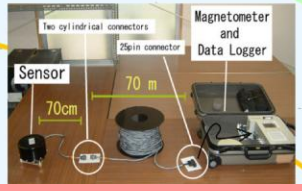
Tromso
IS radar (EISCAT)
meteor radar
MF radar

Iitate and Onagawa Observatories

Icela
auror
magr
ELF/
riometer

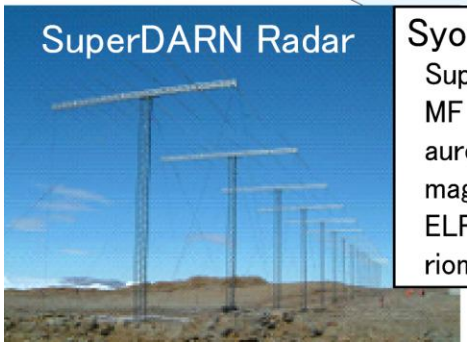
Various observation parameters (temperature, wind, geomagnetism, aurora, etc.) taken by various observation techniques at various locations and altitudes

Equatorial Atmosphere Observatory



Such observational data not necessarily well used in scientific researches so far

→ What's the problem?

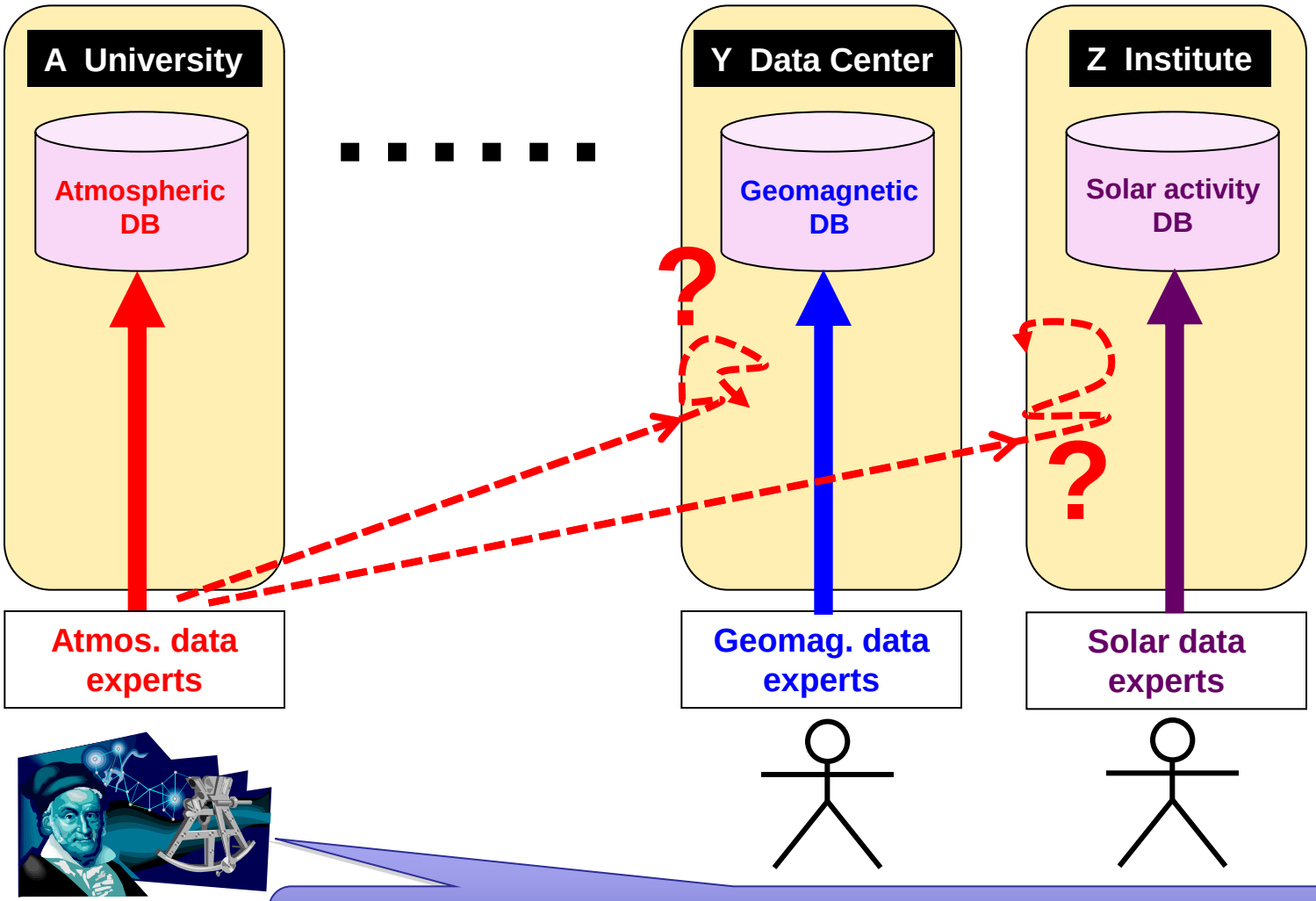


Syowa Station
SuperDARN radar x2
MF radar
aurora imagers
magnetometer
ELF/VLF receiver
riometer

Peru Ica University

▲ MST radar
MF/meteor radar
◆ MAGDAS magnetometer
▲ FM – CW radar
● OMTI imager
◆ WDC magnetometer
— Magnetic Equator
(IGRF2005, Height 100km)

Problem with databases



Hard to even reach to the other disciplinary data due to lack of information!

Database access through metadata DB

- Observation time
  ex) *2011-03-29 07:30:00*
- Observation location
  ex) *34.85N, 135.10E*
- Instrument type
  ex) *VHF radar*
- Location of data file
  ex) *www.rish.kyoto-u…*
- Contact
  ex) *hhayashi@rish…*
- … etc.

A University

Atmospheric DB

metadata generation

Metadata DB

Y Data Center

Geomagnetic DB

Metadata DB

Z Institute

Solar activity DB

Metadata DB

internet

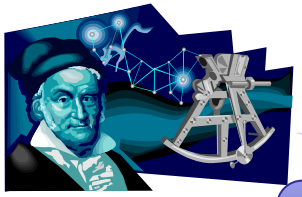
internet

metadata sharing among DBs

Atmos. data experts

Geomag. data experts

Solar data experts



Easy to access various kinds of data from other disciplines by using metadata!

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Project Timeline

	ITEMS	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	REMARKS
Virtual Information Center	Installation & Operation	Install system			Update system			Construct the integrated research environment (video and/or web conference system, etc.)
	Extension				To be beta-released on April 1st !!			Wrap up the project and discuss further extension of the system to other discipline
Metadata DB system	Development	Make prototype	Develop regular system	Open metadata DB to public				Design and build the IUGONET metadata DB system on the basis of DSpace
	Operation				Update computers			Conduct regular operation of the metadata DB and customize it as needed
Metadata	Design of metadata format	Release ver.1 format	Prepare documents	Update format as needed				Formulate the IUGONET common metadata format and keep updating it if necessary
	Creation of metadata				Target relatively old, undatabased items			Create metadata in the designated format and register them in the metadata DB system
Analysis Software	Survey & Specification of analysis software	Specification	Prepare documents					Design an integrated analysis software to download, visualize, and analyze data provided from the IUGONET institutions
	Programming			Open software to public	Target relatively old, undatabased items			Develop the IUGONET analysis software by using TDAS (a set of IDL subroutines)
Others	Rearrangement of observational DBs		Rearrange DBs corresponding to metadata & software development		Arrange relatively old, undatabased items and digitize analogue data			Rearrange existing observational DBs and newly compile DBs of undatabsed items
	Management of project website	Build project homepage						Provide project information to the public through the website

Today

IUGONET

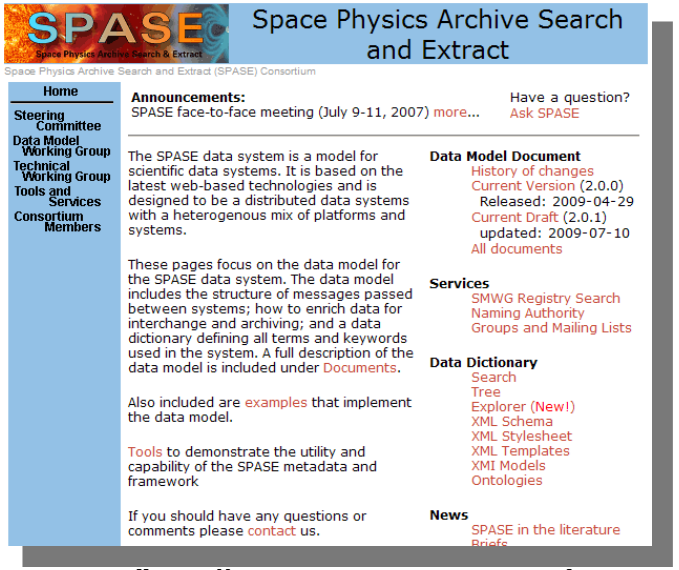
Design of metadata format

- **Many metadata formats available in the Earth and planetary sciences !**
  - Dublin Core
  - ISO 19115 / 19139
  - GCMD DIF
  - FGDC CSDGM
  - IPY Metadata Profile
  - ISTP Standards
  - SPASE
  - …

- **IUGONET adopted SPASE with some modifications**

originally developed to describe research resources regarding heliospheric and magnetospheric satellite observations

- closely related to STP and upper atmospheric researches (➔ easy to use as a base format)
- new metadata elements & words appendable (➔ customizable according to our data)
- widely-used in existing Virtual Observatories (➔ possible metadata exchanges)



(http://www.spase-group.org)

Creation of metadata

EXAMPLE : Metadata of Numerical Data

ResourceID: space://IUGONET/NumericalData/EAR/RAO/EAR/trop_std_netcdf
ResourceHeader:
  ResourceName: EAR standard tropospheric observation mode
  ReleaseDate: 2010-04-12
  Description: Zonal, meridional, vertical winds, beam echo intensity, and spectral width
    data taken by the EAR operated in the standard …
  Acknowledgement: If you acquire EAR data, we ask that you acknowledge us in …
  Contact:
    PersonID: spase://IUGONET/Person/EAR.Management.Group
    Role: General Contact
AccessInformation:
  RepositoryID: spase://IUGONET/Repository/RISH/RISHDB
  Availability: Online
  AccessRights: Open
  AccessURL:
    URL: http://www.rish.kyoto-u.ac.jp/ear/data/index.html
  Format: NetCDF
…

- **Metadata of instrument, observatory, person, repository also created**
- **Each metadata file written in XML format**

Metadata to be archived

Tohoku Univ.

- Geomagnetic data: PC3 index, Onagawa fluxgate and search coil magnetometers
- HF-band radio wave data: Jupiter radio wave, Sun/Jupiter wide band radio wave
- VHF-band: Jupiter radio spectral data, Solar radio spectral data
- LF-band: Standard radio wave phase-amplitude variation data

National Institute of Polar Research

- Syowa Station (Antarctica): Aurora camera, magnetometers, Upper Atmos. Physics Monitoring Obs., Imaging Riometer, 1-100Hz ULF/ELF Electromagnetic wave, Fabry-Perot Imager, SuperDARN HF radar, MF radar, Unmanned magnetometer network, Sodium Lidar
- Upper Atmosphere Physics Obs. at Zhongshan Station, All-skyimager at South Pole station
- Conjugate Obs. at Iceland: fluxgate/induction magnetometer, Imaging riometer, EISCAT radar, NIPR/Norway Svalbard meteor radar, Tromso meteor radar, Auroral and Airglow obs. at Svalbard and Tromso

Solar-Terrestrial Environment Lab., Nagoya Univ.

- NO, NO2, NOx, O3 density, Aerosol chemical composition, Aerosol extinction coefficient, Database of variation of atmosphseric constituents derived by ground spectroscopy obs.
- Ground magnetometers, Airglow and aurora image by All-sky camera, Thermospheric wind speed scintillation, GPS-TEC, GPS scintillation, VHF radar, EISCAT radar, Optical/MF radar/Meteor radar data at Norway
- Spatial profile of solar wind velocity by interplanetary Scintillation (IPS)
- SuperDARN Hokkaido HF radar data

Kwasan and Hida Observatories, Kyoto Univ.

- FMT: Event-list, Movies of outstanding events, Real-time images, Digital raw data
- SMART: Hα full-disk solar images, Hα partial images, Hα real-time images, event catalog, movies, full-disk magnetoram
- DST: Hα partial solar QL images, Hα partial images, Spectrograph QL images, Spectrograph data

WDC/Kyoto, Kyoto Univ.

- Geomagnetic indices(final,provisional,quick look) ← AE, SYM/ASY, Geomagnetic field digital data(WDC final,WDC prompt), Geomagnetic field analog data
- Geomagnetic field digital data and Barometer data (Original obs. by WDC for Geomag, Kyoto)
- Geomagnetic field model(IGRF), Ionospheric conductivity model (IRI2007)
- Catalogue for archived geomagnetic field data

Research Institute for Sustainable Humanosphere, Kyoto Univ.

- Shigaraki MU Observatory: MU radar(standard tropospheric obs. Mode, standard mesospheric obs. Mode, standard ionospheric obs. Mode, special obs.: Meteor/RASS/FAI), Ionosonde, Radiosonde, Boundary layer radar, L-band lower Tropospheric radar, Lower Thermosphere profiler radar, Ceilometer, AWS
- Equatorial Atmosphere Observatory: EAR(standard tropospheric/ionospheric obs.), Boundary layer radar, X-band weather radar, Ceilometer, Radiosonde
- Other sites: Pontianak MF radar, Pameungpeuk MF radar, Jakarta meteor radar, Kototabang meteor radar, Jakarta boundary layer radar, Darwin radiosonde (DAW,GDP,KHC)(campaign obs.), Serpong boundary layer/Meteor radar

Space Environment Research Center, Kyushu Univ.

- Ground magnetometers(MAGDAS, CPMN)
- FM-CW radar
- Geomagnetic Pc5 Index, EE Index

Development of metadata DB system

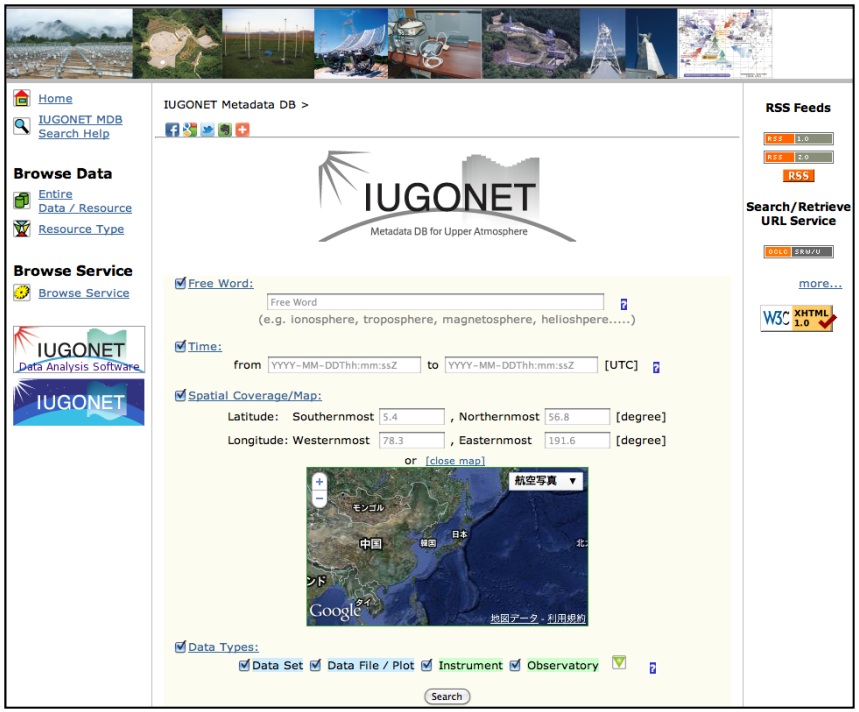
- **IUGONET has been building a metadata DB based on DSpace**

a free, repository software widely used by digital repositories in many universities over the world

- **IUGONET metadata DB :**

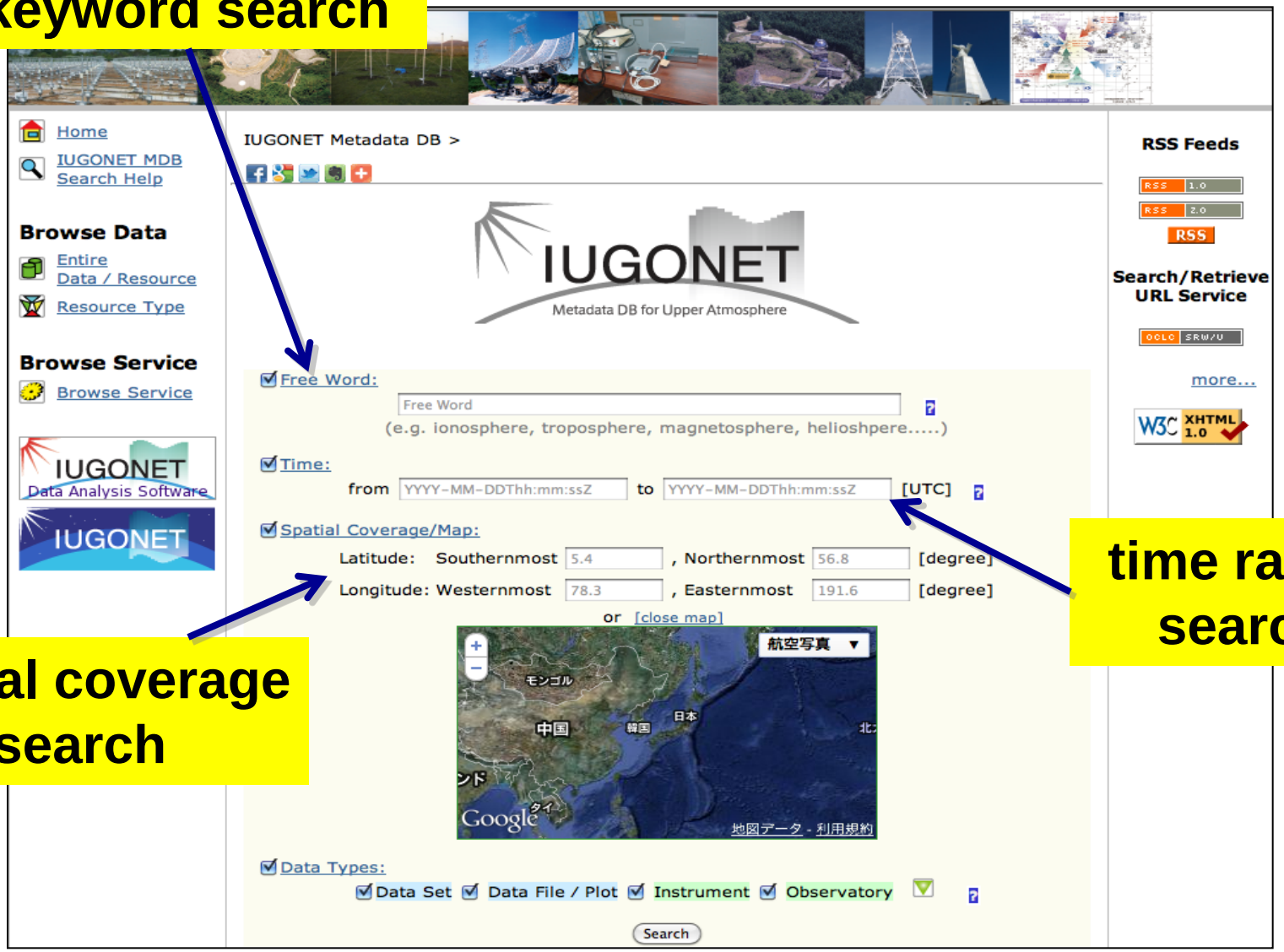
http://search.iugonet.org/iugonet/

User ID = iugonet
Password = iugonet



Metadata DB system – search form

keyword search



spatial coverage search

time range search

Metadata DB system – search result

search result

Relative Stop Date: 14 days ago (-P14D)
http://gemsissc.stelab.nagoya-u.ac.jp/erg/

Repository: spase://IUGONET/Repository/STEL/ERG-SC
Instrument: spase://IUGONET/Instrument/STEL/SuperDARN/HOK/HFradar

The common time fitacf CDF data of SuperDARN King Salmon HF radar distributed by ERG-SC

NumericalData

Common mode data obtained by SuperDARN King Salmon HF radar. Data files are distributed in the CDF format th rough the ERG-SC repository
Start Date: 2006-12-02T00:00:00
Relative Stop Date: 180 days ago (-P180D)
http://gemsissc.stelab.nagoya-u.ac.jp/erg/

Repository: spase://IUGONET/Repository/STEL/ERG-SC
Instrument: spase://IUGONET/Instrument/STEL/SuperDARN/KSR/HFradar

Standard observation data of the troposphere and lower stratosphere taken by the MU radar (N etCDF format)

NumericalData

The 10-minute average observation data in the NetCDF (Network Common Data Form) format taken by the MU ra dar at Shigaraki in the Shiga prefecture, Japan (34.85N, 136.10E, 385m MSL), which has been operated in the sta ndard observation mode of the troposphere and stratosphere. The observation data are stored in the NetCDF files of each day. The file name is (year)(month)(day).nc. The NetCDF data include range, height, time, three compone nts of wind velocity, radial Doppler velocity, echo power, spectral width and noise level for each beam number an d so on. The azimuth and zenith angles of beam 1, 2, 3, 4 and 5 are (0, 0), (0, 10), (90, 10), (180, 10) and (270, 10), respectively, in unit of degree. The value of 1.0e+10 means missing data.
Start Date: 1986-03-16T15:05:00
Relative Stop Date: 14 days ago (-P14D)
http://www.rish.kyoto-u.ac.jp/radar-group/mu/data/

Repository: spase://IUGONET/Repository/RISH/RISHDB
Instrument: spase://IUGONET/Instrument/RISH/misc/SGK/MUradar

Field-aligned irregularity (FAI) observation data of the ionosphere taken by the EAR (NetCDF for mat)

NumericalData

The field-aligned irregularity (FAI) observation data in the NetCDF (Network Common Data From) format taken by the equatorial atmosphere radar (EAR) at Kototabang, Indonesia (0.20S, 100.32E, 865m MSL). This FAI observatio n mode covers a wide altitude range from 80 to 600 km in the ionosphere (D-region (below 90 km), E-region (90- 150 km), and F-region (above 150 km)). The observation data are stored in the NetCDF files of each day and obse rvation parameter. The file name is (year)(month)(day).(observation parameter).nc. The NetCDF data include ran ge, height, time, radial Doppler velocity, echo power, spectral width and noise level for each beam number and s o on. Details of the observation parameter are described in the EAR-FAI homepage (http://www.rish.kyoto-u.ac.jp /ear/data-fai/index.html). The value of 1.0e+10 means missing data.

Metadata DB system – detailed metadata

details of metadata

ResourceName:

Standard observation data of the troposphere and lower stratosphere ta
format)

Description:

The 10-minute average observation data in the NetCDF (Network Common Data Form) format taken by the MU radar at Shigaraki in the Shiga prefecture, Japan (34.85N, 136.10E, 385m MSL), which has been operated in the standard observation mode of the troposphere and stratosphere. The observation data are stored in the NetCDF files of each day. The file name is (year)(month)(day).nc. The NetCDF data include range, height, time, three components of wind velocity, radial Doppler velocity, echo power, spectral width and noise level for each beam number and so on. The azimuth and zenith angles of beam 1, 2, 3, 4 and 5 are (0, 0), (0, 10), (90, 10), (180, 10) and (270, 10), respectively, in unit of degree. The value of 1.0e+10 means missing data.

Acknowledgement:

If you acquire MU radar data, we ask that you acknowledge us in your use of the data. This may be done by including text such as MU radar data provided by Research Institute for Sustainable Humanosphere of Kyoto University. We would also appreciate receiving a copy of the relevant publications.

ReleaseDate:

2011-03-06T00:00:00

Contact PersonID:

0: spase://IUGONET/Person/Hiroyuki.Hashiguchi
1: spase://IUGONET/Person/MU.Radar.Management.Group
2: spase://IUGONET/Person/Noriko.Hashiguchi
3: spase://IUGONET/Person/Atsuki.Shinbori

Contact Role:

0: PrincipalInvestigator
1: GeneralContact
2: DataProducer
3: MetadataContact

AccessInformation RepositoryID:

spase://IUGONET/Repository/RISH/RISHDB

AccessInformation AccessURL URL:

http://www.rish.kyoto-u.ac.jp/radar-group/mu/data/

AccessInformation Availability:

Online

AcessURL points the location of dataset you are interested in.

AccessInformation AccessRights:

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	Pro…			Open software to public	Target relatively old, undatabased items			Develop the IUGONET analysis software by using TDAS (a set of IDL subroutines)
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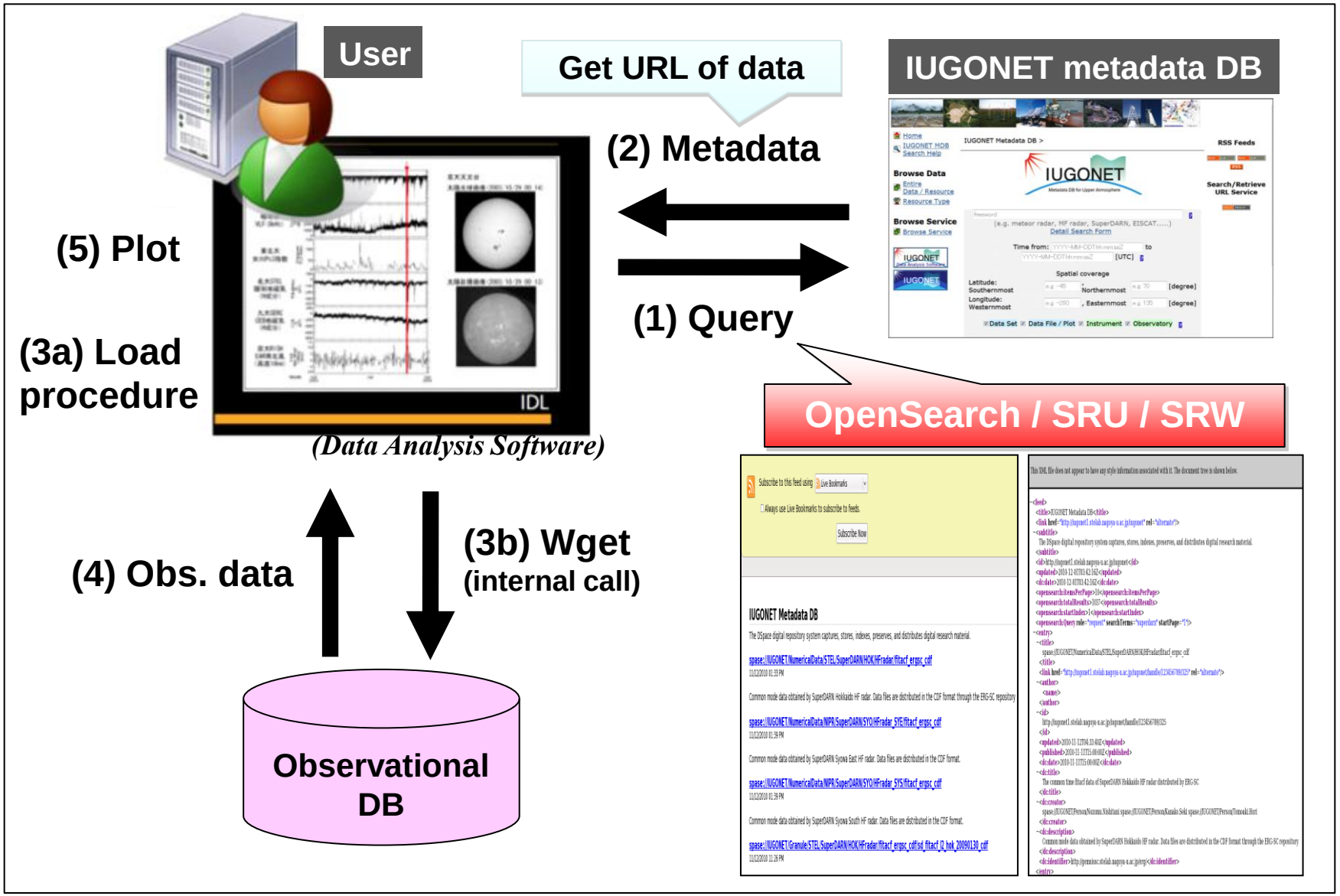
	Management of project website	Build project homepage						Provide project information to the public through the website

Dr. Shinbori will talk about the IUGNET analysis software

Today

Use of metadata DB by software

Planning to use metadata DB from analysis software to get some info (e.g. URL)



Regional CAWSES-II MLT Radar Workshop

~ Singapore, 8 & 9 March 2010 ~

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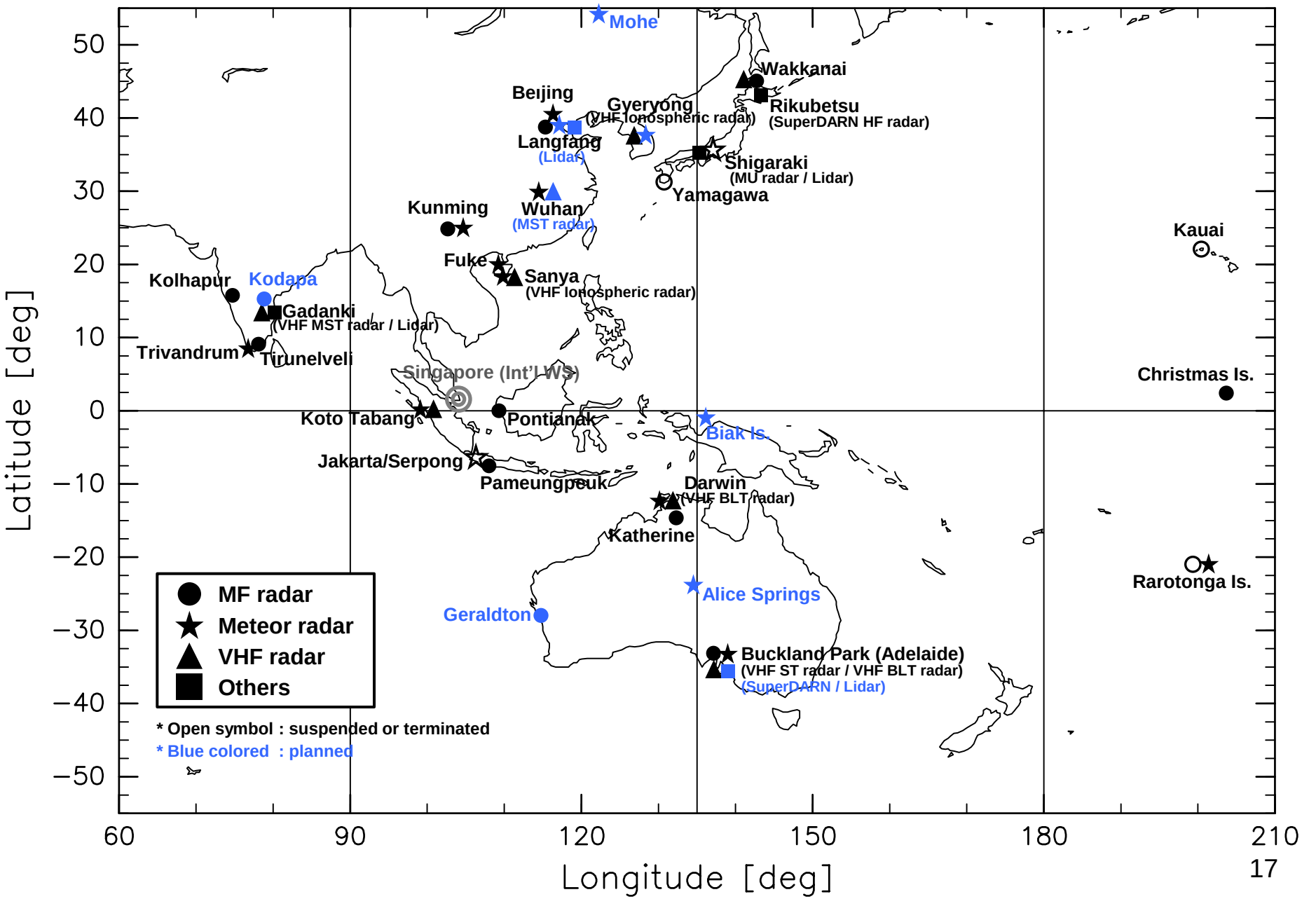
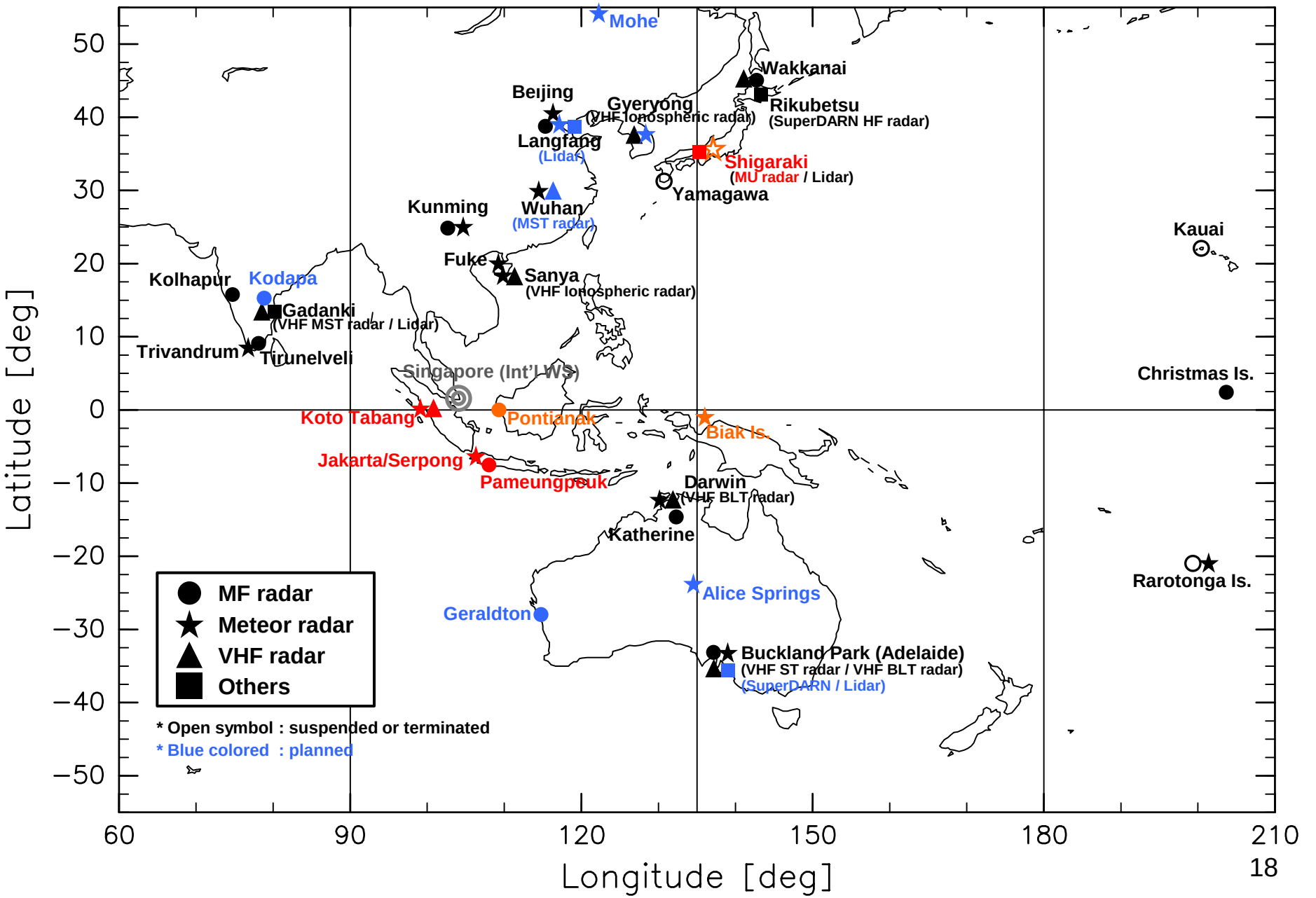
Asia-oceanian MLT radar network



IUGONET

Asia-oceanian MLT radar network



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Summary

- **The IUGONET project builds e-infrastructure (metadata database and analysis software) to promote effective use of upper atmospheric data taken by ground-based observations.**

- **The IUGONET metadata database is scheduled to be beta-released on April 1st , 2011.**

- **The IUGONET metadata database should be used to facilitate data exchange among the Asia-oceanian MLT radar network.**